

GEOLOGICAL REPORT on the PARADISE GROUP

about 4 miles southeast of Lempriere,
52° 119° S.E., Kamloops M.D.

by Anthony Rich 83.D-6

P. Eng.: Dr. J.A. Gower

Claims held by Anthony Rich

Field work done August 7 - 10, 1968

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INTRODUCTION

The claims comprising the Paradise group were staked on carbonatite showings in August of 1967. The field work for this report was done between August 7 and August 10, 1968. The party consisted of Dr. J.A. Gower, Dr. A.N. Mariano, J.J. Barakso and myself. Miss E.E. French and C.S. Ney were on the property on August 7th.

Men and supplies were transported to and from the property by helicopter from Blue River on the 7th. and 10th. of August. The helicopter was chartered out of Revelstoke, but only the cost of transportation out of Blue River is applied for on the accompanying form B.

The purpose of the trip was to map the area geologically and topographically, and to determine the economic potential of the carbonatite.

Isotopic data for certain of the specimens are included in the report. These data are considered essential in defining the carbonates of this area to be carbonatites.

LOCATION

The Paradise claim group lies on the west slope of the Monashee Range in east-central British Columbia. The claims are about 23 miles north-northeast of Blue River, about 4 miles southeast of Lempriere and about 3 miles east of Mile 109 on the C.N. Railway. The group is at an approximate Latitude of $52^{\circ} 25'$ and Longitude of $119^{\circ} 05'$.

ACCESSIBILITY

The recently completed Yellowhead Highway passes $3\frac{1}{2}$ miles to the west, on the west bank of the North Thompson River. The closest bridge is three miles to the north, at Lempriere. From here access to the property is on foot.

closures in all cases were less than five feet with most less than three feet. Horizontal closure was generally less than 30 feet. These closures are considered good for this type of survey in rugged terrain.

GEOLOGY

1. Schists and Gneisses

The country rocks in this area between the North Thompson and the Canoe River are thought to be either an extension of the Shuswap Terrane or a metamorphosed region of the Kaza Group. Within the area surveyed, the country rock is principally garnet biotite quartz schist or feldspar hornblende quartz gneiss. The rocks generally weather a brownish grey. On the exposed slopes the rocks have the common black lichen cover, but in the region of station 19* a vivid yellow lichen has developed on the cliff face.

Evidence of retrograde metamorphism is shown by the garnets in the schist. The garnet morphology is retained while the mineral, for a large part, has altered to sericite and chlorite. On the ridge between stations 16 and 31 many of the schists and gneisses exhibit well developed kyanite crystals which are up to two inches in length.

There is a marked development of amphiboles in the country rock near the contacts with the carbonatite. A rock consisting mainly of amphibole and vermiculite is often found at the actual contact.

2. Pegmatite

There are numerous pegmatite sills and dykes in the area which vary in width from a few inches to several feet. Their composition can be generally represented as follows :-

* All stations and locations referred to in this section are to be found on Map 1 which is in the envelope on the back cover.

The claims lie about 5,000 feet above the river. The area is heavily timbered. Underbrush and deadfall to timber-line are bad ('devils club' average about five feet in height). Experience has proven that the most economic way to get men and equipment to the property is by helicopter.

PHYSICAL FEATURES AND GEOMORPHOLOGY

The claims surveyed lie between about 6,400 and 8,500 feet in elevation. Timber-line is at about 6,900 feet. The claims straddle the southwest ridge of Paradise Mountain. The south side of this ridge is steep, but for the most part accessible. The northwest side of the ridge is comprised of cliff faces, and outcrop above about 7,300 feet cannot be reached with any measure of safety.

The chief erosional agent in the area has been ice. Paradise Lake is a cirque lake. The whole northwest face of Paradise Mountain describes a rather open, cirque-like form. There is a considerable development of talus below about 7,300 feet with blocks below the northwest face up to 12 feet across.

Small creeks emerge as springs from the lower parts of the talus. Considerable areas of the north slope were still covered with snow at the time of the survey.

SURVEY METHOD

A horizontal and vertical survey was performed with the aid of a Gurley alidade, using a plane table and a fourteen foot rod graduated in tenths of a foot. The Beaman arc of the alidade was used to measure vertical angles.

Station 18 was estimated to have an elevation of 7,420 feet. This estimate was made using Topographic map 83 D/6 E (Lempriere - E half) of the 1 : 50,000 series of the National Topographic System. This elevation was used as starting elevation for the survey. Vertical and horizontal control was maintained through triangulation to prominent points and to earlier stations. Vertical

Quartz	0 - 90%
Feldspars	10 - 90%
Muscovite	0 - 20%
Biotite	0 - 5%

Most of the pegmatite outcrops contain over 50% quartz but near the contact with the carbonatite (station 30) there is considerably more sodic feldspar and biotite developed - sometimes to the exclusion of quartz and muscovite. Huge blocks of pegmatite are found in the talus south of station 24. Large blocks of muscovite and biotite are developed in this region.

3. Granulite

There is a conspicuous lens of granulite on the steep cliff about 2,000 feet east of station 23. This granulite weathers light grey and contrasts sharply with the grey-brown schists. The lens is about 70 feet thick.

Blocks of the granulite were examined in the talus. It appears to be coarsely banded and it approximates a granite or granodiorite in composition. The principal mafic mineral is biotite which constitutes about 5% of the rock.

4. Carbonatite and Nepheline Syenite

There are numerous exposures of carbonatite within the mapped area. Most of the observed occurrences appear to be concordant with the country rock. Both dolomitic and calcitic carbonatites were noted. Nepheline syenite has been found at only one location, A.

In August of 1967, samples of carbonate were taken from locations 20, C and D. A sample of nepheline syenite was obtained from location A. These four samples, together with a suite from the Verity property to the west and the Howard Creek property to the east, were studied by the author at the University of Alberta, Edmonton. Below are listed the analytical data which are

considered pertinent to this report : -

<u>Spec.</u>	<u>Strontium</u> <u>ppm</u>	<u>Min. used</u> <u>for isotope</u> <u>analysis</u>	$\delta C^{13} \text{ ‰/‰ PDB}$	$\delta O^{18} \text{ ‰/‰ PDB}$	Sr^{87}/Sr^{86}
20	4,100	dolomite	-3.7 ± 0.2	-23.3 ± 0.2	
C	2,950	calcite	-5.6 ± 0.2	-19.9 ± 0.2	
D	5,650	dolomite	-5.3 ± 0.2	-22.5 ± 0.2	
A	1,100	whole rock			0.7047 ± 0.0004

Strontium analyses were performed by X-ray fluorescence spectroscopy and the figures quoted above have an accuracy of ± 5%.

The isotopic composition of the carbon and the oxygen in the carbonate is defined as follows:

$$\delta C^{13} = \left[\frac{C^{13}/C^{12}(\text{sample})}{C^{13}/C^{12}(\text{PDB std.})} - 1 \right] \times 1,000 \text{ ‰/‰ PDB}$$

δO^{18} is defined by an analogous expression using the O^{18}/O^{16} ratios of sample and standard.

The Sr^{87}/Sr^{86} ratio is, of course absolute. No correction has been applied for the Rb^{87} content - this is negligible.

Listed below are the reasons why the carbonates in this area are considered to be carbonatites.

(i) The strontium content of the carbonate is higher than that of the average sedimentary or metamorphic carbonate by a factor of at least ten.

(ii) The δC^{13} and δO^{18} values are well within the range for carbonatites - -3 to -6 ‰ for C^{13} and -18 to -26 ‰ for O^{18} .

(iii) Carbonatite bodies usually have a related nepheline syenite body in the area.

(iv) The nepheline syenite has a low $\text{Sr}^{87}/\text{Sr}^{86}$ ratio. With rocks of crustal origin this ratio is generally higher than 0.706 (after correcting for radiogenic Sr^{87}). Simatic rocks and meteorites have strontium ratios between 0.701 and 0.705. This would indicate that the nepheline syenite, or at least the contained strontium, is of sub-crustal origin. The carbonates in this area have not yet been analysed for $\text{Sr}^{87/86}$ but they are presumed to be similar in composition to the Verity carbonates which have a $\text{Sr}^{87}/\text{Sr}^{86}$ ratio of .7035.

(v) The carbonate rocks have a peculiar mineralogy; that is they contain minerals such as sodic amphiboles, pyrochlore, vermiculite, magnetite, apatite, zircon, olivine etc..

The carbonatites vary somewhat from one outcrop to another. Each exposure is described by location below.

Location D is a large area covered with fine dolomitic carbonatite talus. Pits dug into the talus to a depth of two feet, show the carbonatite in place. The rock is light brown in colour and is composed chiefly of fairly coarse-grained dolomite (75 - 80% of the rock), apatite (10 - 15%), magnetite (5 - 10%), light green amphibole (about 5%) and olivine (2 - 4%). The apatite is colourless or very pale green and is in the form of rounded crystals around 3mm. in length. It is more resistant to weathering than the other minerals in the rock. It is a fluor-hydroxy apatite. Magnetite forms sporadic pieces up to two cms. in size. The mineral has a fair octahedral parting. Amphibole occurs as light green slender crystals about 2 mm. in length. The mineral has been identified as richterite by A.N. Mariano, using X ray diffraction technique. Olivine is present as small rounded blebs, brown or green in colour and often transparent. It is probably near forsterite in composition.

Contacts with the country rock are not exposed. The attitude of the carbonatite shown on map 1 is the attitude of the compositional banding. This attitude is similar to that of the surrounding rocks.

Location E is separated from location D by about 30 feet. Like location D it has a long talus slope composed of small fragments of carbonatite. Near the

top of the slope is a large block, apparently in place, which is composed of very coarsely crystalline calcite (about 40%) and an amphibole which forms the balance of the rock. The amphibole (possibly actinolite) is dark green and forms large fibrous masses which connect in all directions through the rock. The calcite is interstitial to the silicate.

The rock gives the impression of having crystallized from a molten or semi-molten state - that is, it appears to be an intrusive or remobilized carbonate.

The talus between D and E contains a large proportion of gneiss with the carbonate and it is probable that the two exposures of carbonatite are separated by a thin band of country rock.

Location C is a small outcrop of calcitic carbonatite near the top of the ridge above D and E. The attitude of this outcrop could not be determined as the blocks of carbonate appear to have slumped somewhat. The rock seems to be fairly resistant to weathering. The weathered surface is off-white. This carbonatite is composed of white calcite (about 75%), magnetite (5 - 10%), amphibole (about 5%), and apatite (10 - 15%). The rock also contains up to 5% pyrite, and goethite pseudomorphs after pyrite, in cubes up to about 4mm in size. Pyrochlore occurs in this outcrop as tiny dark brown octahedra, barely visible to the naked eye. The pyrochlore is radioactive (uranian) and tiny pink haloes appear in the calcite around the mineral grains.

Location G is a small outcrop of concordant carbonatite similar to that at location D.

Location B The talus about 50 feet below station 30 contains over 30% carbonatite. This carbonatite is in the form of large angular blocks which weather to a grey-brown. Carbonatite is found as a dominant constituent of the talus for nearly 500 feet to the east and 700 feet to the west. About 500 feet to the west were found blocks consisting of carbonatite intermingled with pegmatite. The pegmatite has a high feldspar content and very little quartz. Amphibole has developed at the contacts of the two rock types. No carbonatite was found in place on the cliffs above, and since the carbonate blocks cease rather abruptly as one progresses up the talus slope, it is

inferred that the carbonatite lies in place under the talus, just below the top of the slope.

Apart from the slight difference in colour of the weathered surface, this carbonatite is similar to that found at location D. Some specimens contain about 20% apatite and occasional small crystals of pyrochlore are found in the rock.

Station 20 is a small exposure of carbonatite about 8 feet square with a fair development of talus below. It has weathered brown. This rock is very similar in appearance to that found at E. It contains abundant fibrous amphibole (about 40%), but the carbonate is dolomite, which constitutes the remainder of the rock. In contrast to specimen E, the amphiboles approximate bands which are vaguely parallel. The attitude of this 'banding' was measured and found to be nearly perpendicular (in dip) to that of the surrounding schist.

Station 26 This is a band of carbonatite outcropping at the base of a steep bluff. The exposure measures about 5 feet in thickness and 50 feet in length. The basal contact is not exposed. The rock is mainly dolomitic with minor calcite. It contains rich, but spotty apatite, amphibole and vermiculite.

Location F This outcrop is on a steep hillside below timber-line. The carbonate is well exposed at this point. The rock is similar in composition to that found at B and D, but differs in certain secondary structures. There is a marked compositional banding which affords the rock a fair cleavage. Magnetite occurs as thick, isolated boudins which are up to three inches across.

The banding and cleavage are parallel to the gneissosity of the country rock. The upper contact with the gneiss is fairly sharp. Near the contact there is a high percentage of mica in the carbonate and much amphibole in the gneiss. The lower contact was covered, but 20 feet east of the exposure was a pit containing a calcitic rock with abundant, large amphibole crystals.

Above F there are several pits to bedrock. Many of these expose carbonatite similar to that found at the lower elevation.

Location A Nepheline syenite was located at the base of the cliff east of station 23. It is exposed for a thickness of 12 - 15 feet. The syenite has the same attitude as most of the schists and gneisses in the cirque, but it is not conformable with the schist at the upper contact. The schist here forms a small fold about 20 feet across. The axis strikes about 220° , the axial plane is horizontal; the fold is open to the northwest. The lower contact of the syenite was beneath the snow.

The rock is medium grained and contains about 40% sodium and potassium feldspars, 40% nepheline and 20% biotite. There are tiny, euhedral, red-brown zircons scattered throughout the rock. Both the nepheline and the feldspars are pure white.

About 20 feet below the outcrop are large blocks of talus which are part nepheline syenite and part carbonatite. The two rock types are easily distinguishable on the weathered surface, but on the fresh surface the carbonatite is identical in texture to the syenite. The carbonatite is about 80% white calcite and 20% biotite - the contact with the syenite is sharp and thin.

As the carbonatite was not observed in place, it is presumed to be at the lower contact or at a lower point in the nepheline syenite - beneath the snow.

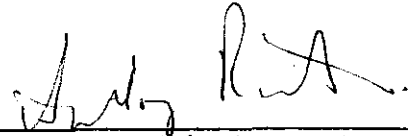
CONCLUSIONS

The carbonatites of the Paradise group appear, for the most part, to be concordant bodies. The exposures of discordant carbonate are small and high in silicate. They are thought to be remobilized parts of the main bodies. It does not seem reasonable that all the outcrops fringe a single sheet. It is more feasible that there exist two main bodies or sheets, separated by a 'stratigraphic' thickness of about 200 feet. One sheet incorporates stations F, D, G and 26; the lower sheet contains stations 29, A and B. Minor calcitic bodies parallel the upper sheet.

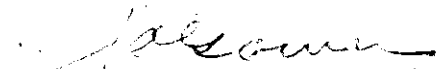
The Paradise carbonatites bear strong resemblances to the carbonatites of Howard Creek to the east and the Verity property to the west (see maps 2 & 3).

It is probable that the Paradise carbonatite correlates with part of the Verity, and possible that it correlates with the Howard Creek body.

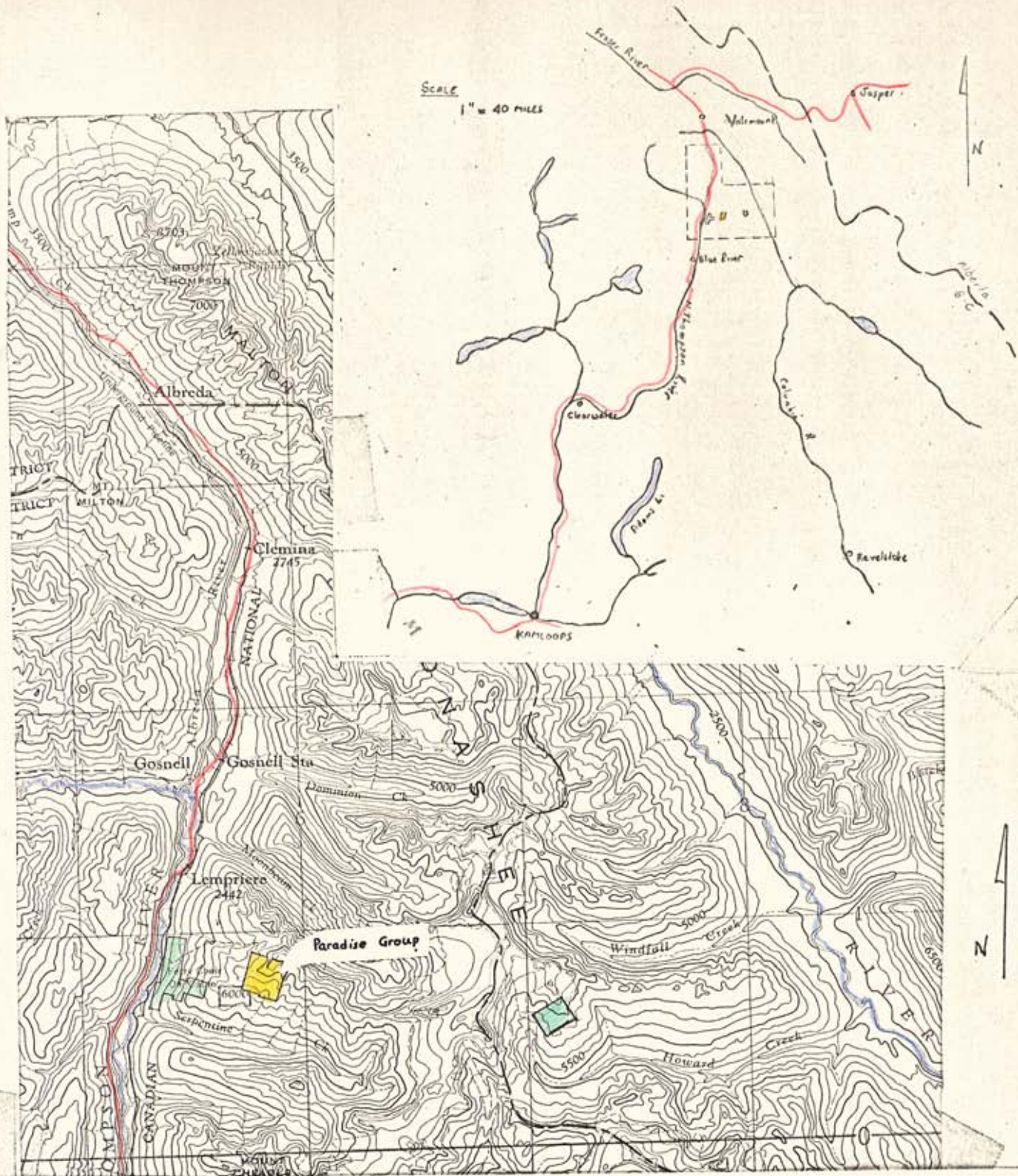
It is difficult to speculate on the origin of the carbonatites in this area on the basis of the Paradise showings alone. Work is already in progress to map the Verity property. When this is completed it may be possible to draw some conclusions on the genesis of these peculiar rocks.



Anthony Rich (Author)



J. A. Gower (P/Eng)



MAP 2

showing the location of the Verity, Paradise and Howard Creek properties.

Scale 1 : 250,000

September 14, 1968

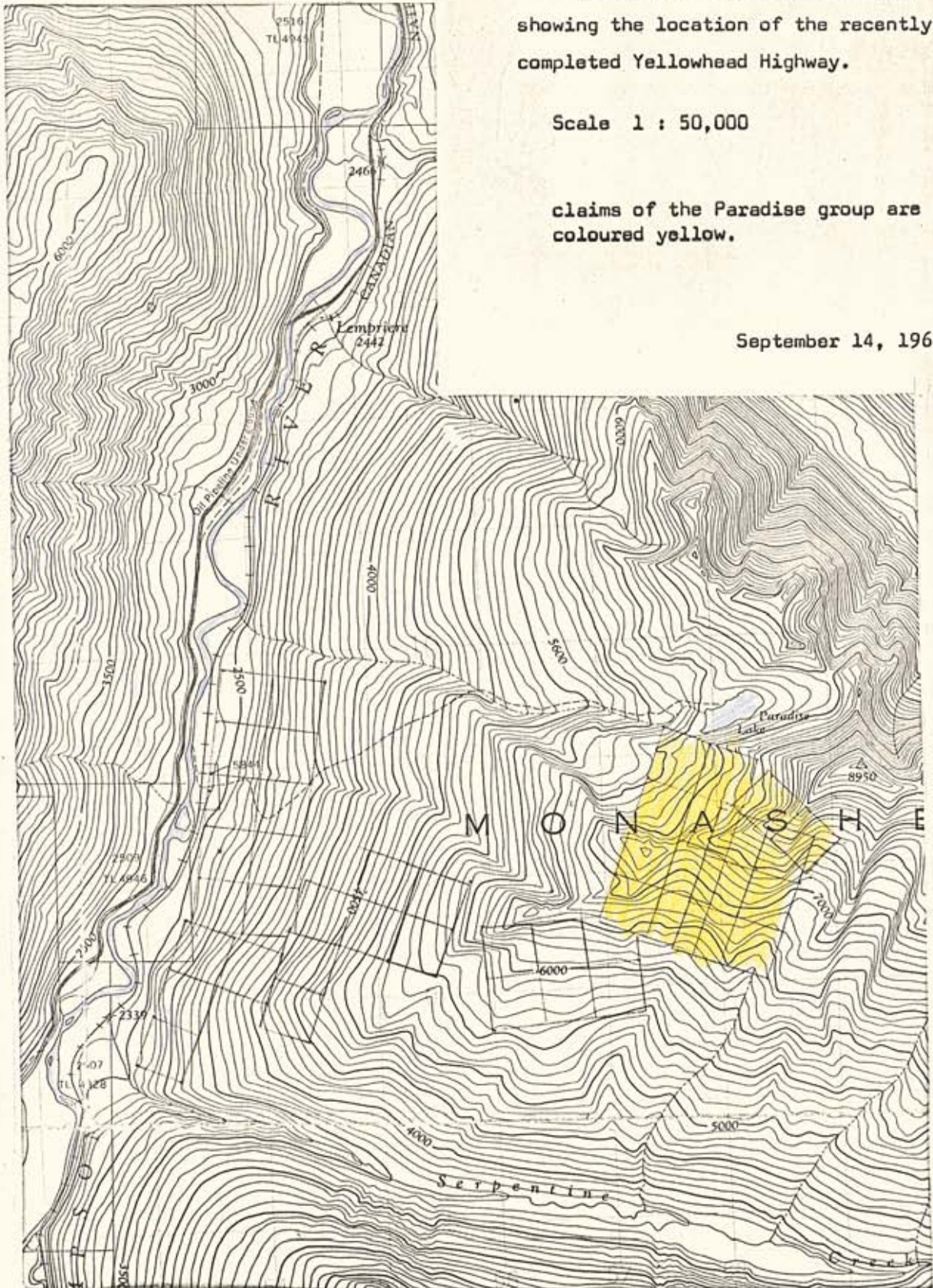
MAP 3.

Verity and Paradise properties -
showing the location of the recently
completed Yellowhead Highway.

Scale 1 : 50,000

claims of the Paradise group are
coloured yellow.

September 14, 1968

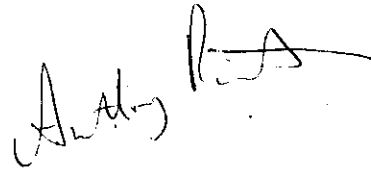


I, Anthony Rich have the degree of Bachelor of Science in Geophysics which I received from the University of Alberta, Edmonton, in 1966.

I have since completed two years of a Master's degree program at the same institution.

I have worked as a geologist and geochemist each summer since 1965, in the Yukon and British Columbia,

I have all interest in the claims constituting the Paradise group.

A handwritten signature in cursive script, appearing to read "Anthony Rich", with a long horizontal flourish extending to the right.

Anthony Rich

September 14, 1968.

GEOLOGICAL MAP OF THE PARADISE GROUP

SURVEYED & DRAWN BY A. RICH

GEOLOGISTS: DR. J. D. GOWSE
DR. A. MARRAS
J. J. BRANCO
C. S. HET
A. RICH

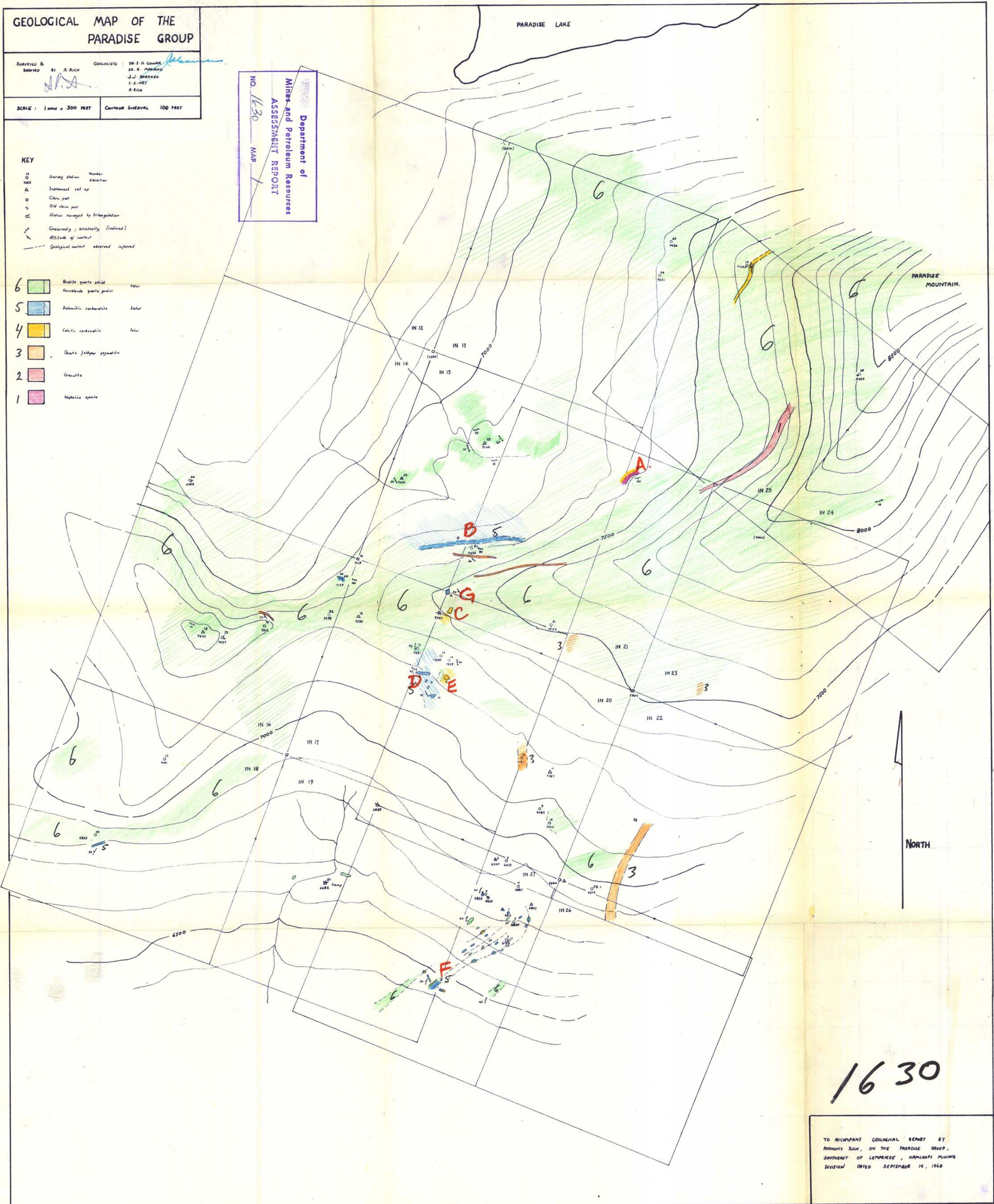
SCALE: 1 inch = 300 FEET Contour Interval 100 FEET

Department of
Mines and Petroleum Resources
ASSESSMENT REPORT
NO. 1630
MAP

KEY

- H Survey station Number
- O Station elevation
- △ Instrument set up
- Claim post
- Old claim post
- OC Station surveyed by triangulation
- ~ Contour interval (indicated)
- Altitude of contact
- - - Geological contact observed inferred

- 6 Brecciated quartz schist Yellow
- 5 Metakalke quartz gneiss Yellow
- 4 Palaeozoic carbonaceous Yellow
- 3 Calcitic carbonaceous Yellow
- 2 Quartz feldspar gneiss Yellow
- 1 Granite Red
- 1 Nepheline syenite Pink



1630

TO ACCOMPANY GEOLOGICAL REPORT BY
ANTHONY RICH, ON THE PARADISE GROUP,
SOUTHWEST OF LEMPERRE, HAMBROPS MINING
DIVISION DATED SEPTEMBER 14, 1968